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THE RELATION BETWEEN PHYSICAL EDUCATION CURRICULUM TIME ALLOCATION AND OBESITY IN 6-10 YEARS OLD CHILDREN: A CROSS SECTIONAL STUDY

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ABSTRACT. Introduction: Overweight and obesity are major problems in our society, because it's prevalence "among children and adolescents aged 5-19 has risen dramatically from just 4% in 1975 to just over 18% in 2016. The rise has occurred similarly among both boys and girls: in 2016 18% of girls and 19% of boys were overweight. While just under 1% of children and adolescents aged 5-19 were obese in 1975, more 124 million children and adolescents (6% of girls and 8% of boys) were obese in 2016" (WHO, 2021). **Objectives:** The aim of our research is to examine the relationship between the time allocated to physical education at school and overweight/obesity in 6-10 year old children on a global and continental level. **Methods:** Our study is a cross-sectional, population-based descriptive study. We used the data from the World-wide Survey of School Physical Education report published by UNESCO in 2013. We used BMI for the age group 6-10 years from the database published by the Global Burden of Disease Collaborative Network. The GDP data for the countries was taken from the database of the United Nations Economic Commissions for Europe. **Results:** In our study, we analyze data from 145 countries on six continents. The average time devoted to physical education in these countries is 95.6±35.0 minutes per week. The minimum is 30 minutes and the maximum is 225 minutes.

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The 90 minutes occurs with the highest frequency, 26 times. The median also shows the 90-minute value. Examining the results by continent, it is revealed that significantly more time is devoted to school physical education in Europe than in Africa (p=0.020) and Asia (p=0.022), but there is no significant difference between the average of the other three continents and Europe. A Spearman's rank-order correlation was run to assess the relationship between GDP and physical education time allocation. One hundred forty states were included in the analysis. There was a weak positive statistically significant correlation between GDP and physical education time allocation, $r_s(128) = .298$, $p < .001$. **Conclusions:** The amount of time devoted to physical education at school shows a wide variation from state to state. The time allocated to physical education at school is 95.6 minutes on average. Europe and Australia/Oceania are the two continents where the most time (about 110 minutes) is devoted to physical education per week. We did not find a relationship between the time devoted to physical education at school and the frequency of obesity or overweight.

Keywords: *obesity, overweight, physical education, time allocation.*

Introduction

Regardless of whether physical exercise is done at school, in an organized setting or in unorganized circumstances outside of school, it has an effect on both our physical and mental state (Andermo, et al., 2020). As professionals, we are used to highlighting and mentioning the positive effects, but we must be aware that, in some cases, the participants can also have a negative effect (Elbe, Lyhne, Madsen, & Krustrup, 2019). A detailed analysis reveals that School-related physical activity interventions may reduce anxiety, increase resilience, improve well-being and increase positive mental health in children and adolescents (Andermo, et al., 2020). According to the Physical Activity Guidelines Advisory Committee (2018), "regular physical activity can help children and adolescents improve cardiorespiratory fitness, build strong bones and muscles, control weight, reduce symptoms of anxiety and depression, and reduce the risk of developing health conditions such as: heart disease, cancer, type 2 diabetes, high blood preasure, osteoporosis and obesity." Bailey et al. (2009) in a review study divide the impact of school physical education and sports activities on school-aged children into four categories: physical benefits, social benefits, affective benefits and cognitive benefits, presenting numerous studies examining each area.

In 2010, the CDC elaborated a comprehensive study entitled Association Between School-Based Physical Activity, Including Physical Education, and Academic Performance, the summary of which shows that "the results suggest that physical activity is either positively related to academic performance (50.5% of the associations summarized) or that there is not a demonstrated relationship between physical activity and academic performance (48% of the associations summarized). In addition, increasing time during the school day for physical activity does not appear to take away from academic performance" (p. 28). These results are supported by other review studies (Rasberry, et al., 2011).

From a world-wide survey of school physical education by the UNESCO it is revealed that "there is an average 97 minutes weekly (range of 25–270 minutes); in the secondary school phase, there is an average of 99 minutes weekly (range of 25–240 minutes)" (p. 25). More time is spent on school physical education in North America (107-125 minutes), Europe (109-105 minutes) and Oceania (111-100 minutes).

Overweight and obesity are major problems in our society, because it's prevalence "among children and adolescents aged 5-19 has risen dramatically from just 4% in 1975 to just over 18% in 2016. The rise has occurred similarly among both boys and girls: in 2016 18% of girls and 19% of boys were overweight. While just under 1% of children and adolescents aged 5-19 were obese in 1975, more 124 million children and adolescents (6% of girls and 8% of boys) were obese in 2016" (WHO, 2021). "Global age-standardised prevalence of obesity increased from 0.7% (0.4–1.2) in 1975 to 5.6% (4.8–6.5) in 2016 in girls, and from 0.9% (0·5–1·3) in 1975 to 7.8% (6.7–9.1) in 2016 in boys; the prevalence of moderate and severe underweight decreased from 9.2% (6.0–12.9) in 1975 to 8.4% (6.8–10.1) in 2016 in girls and from 14.8% (10.4–19.5) in 1975 to 12.4% (10.3–14.5) in 2016 in boys. Prevalence of moderate and severe underweight was highest in India, at 22.7% (16.7–29.6) among girls and 30.7% (23.5–38.0) among boys" (NCD Risk Factor Collaboration, 2017, p. 2627).

Objectives

The aim of our study is to examine the relationship between the time allocated to physical education at school and overweight/obesity on a global and continental level.

Methods

Our study is a cross-sectional, population-based descriptive study. In the statistical analysis, we used data from UNESCO's World-wide Survey of School Physical Education published in 2013. From this, we obtained data on

the time allocated to school physical education for nearly 150 countries. We used BMI for the age group 6-10 years from the database published by the Global Burden of Disease Collaborative Network (2017). The GDP data for the countries was taken from the database of the United Nations Economic Commissions for Europe.

Results

In our study, we present data from 145 countries on six continents. The average time devoted to physical education in these countries is 95.6±35.0 minutes per week. The minimum is 30 minutes and the maximum is 225 minutes.

Table 1. Time allocation for physical education by continents

Continent	Number of countries [N]	Time allocation for P.E. [min]	Minimum value [min]	Maximum value [min]
Africa	40	87.0±37.4	30 (Algeria)	225 (Ethiopia)
Asia	32	85.8±28.6	35 (Pakistan)	180 (Bangladesh)
Australia	5	111.4±49.8	60 (Samoa)	185 (Papua New Guinea)
Europe	43	110.9±33.1	50 (Cyprus)	220 (France)
North America	15	93.6±32.1	40 (Belize)	183 (Cuba)
South America	9	90.2±29.3	35 (Paraguay)	135 (Chile)
Total	144	95.6±35.0		

The 90 minutes occurs with the highest frequency, 26 times. The median also shows the 90-minute value. Examining the results by continent, it turns out that significantly more time is spent on school physical education in Europe than in Africa (p=0.020) and Asia (p=0.022), but there is no significant difference between the average of the other three continents (Australia, North and South America) and Europe.

A Spearman's rank-order correlation was run to assess the relationship between GDP and physical education time allocation. One hundred forty states were included in the analysis. There was a weak positive statistically significant correlation between GDP and physical education time allocation, $r_s(128) = .298$, $p < .001$.

Examining the relationship between GDP and physical education time allocation by continent, the significant correlation remains only in the case of Asian countries, $\tau_b = .255$, $p = .048$.

Over the last 40 years, data on overweight and obesity show a strong increasing trend, regardless of whether it is children or adults (Ng M, 2014). As

the first Figure shows, there are large differences in both obesity and overweight indicators even within European countries. While only 6-7% of children are obese in the Republic of Moldova and Switzerland, it reaches 20% in Italy and Greece.

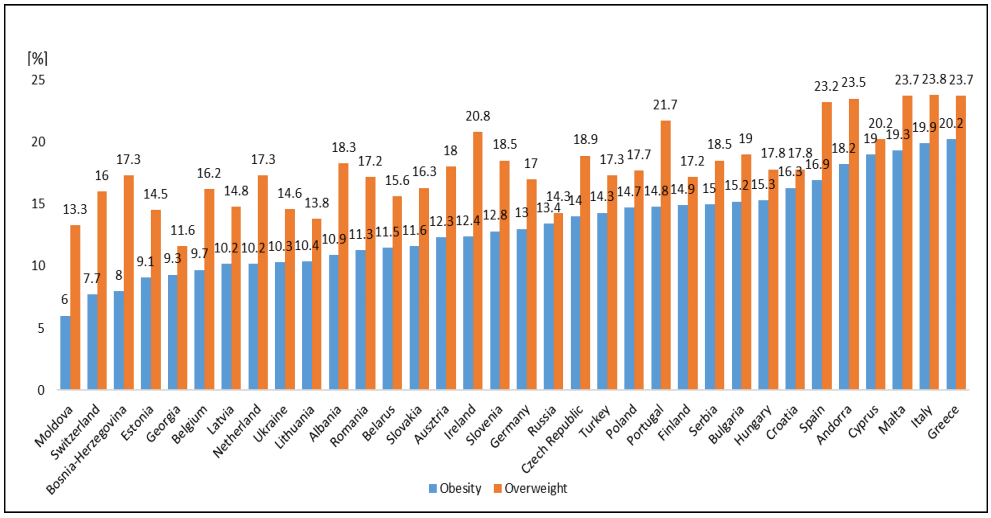

Figure 1. *Prevalence of overweight and obesity in children in 38 European countries*

At the global level r_s (141) = .141, p = .095, as in Europe r_s (40) = .110, p = .501, we did not find an association between the time devoted to physical education at school and the indicators of obesity or overweight. The connection was not found for any continent. Spearman's rank correlation shows a negligible relationship between the time devoted to physical education and the frequency of overweight/ obesity in the case of boys, r_s (141) = .175, p = .038. In European countries, 27.86±5.81% of the examined sample is overweight and 10.65±3.00% obese on average, while in Africa this proportion is 13.64±7.31% and 4.57±4.33%, respectively. Based on these data, the independent sample t test establishes a significant difference, t(78)= 8.842, p =0.000. It is worth noting that while in Europe the overweight indicators are closely followed by the obesity indicators in each country (for example, in the case of Italy, 23.8% are overweight and 19.9% are obese, which means a difference of 3.9%), while in the case of African countries it is up to 3-4 times the proportion of obese compared to overweight is lower. Taking Tunisia as an example, the rate of overweight children is 24.5%, while that of obese children is 8.8%. This trend can be observed in almost all African countries, regardless of population size. In Asia, a large deviation can be observed in the data of the 32 countries included in the analysis. At one extreme, we find countries where the frequency of overweight and obesity

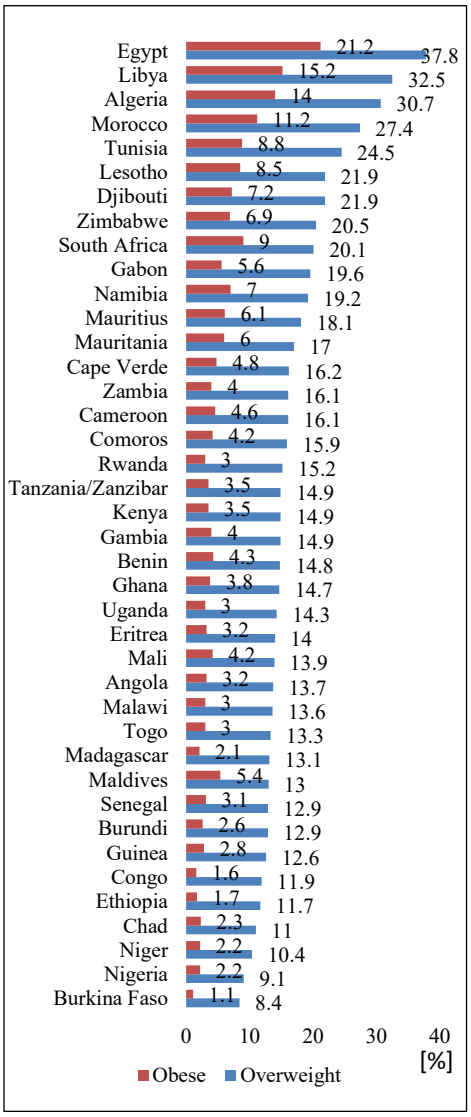

Figure 2. *Prevalence of overweight and obesity in children in Africa*

barely reaches 8-10 percent, while at the other extreme, the frequency of these children is 62-63 percent. It is not surprising that in the case of countries with a higher GDP (for example: Kuwait, Qatar, United Arab Emirates, Bahrain) we find a higher frequency of overweight and obesity. When examined at the global level, we can measure a strong correlation between the GDP of the countries and the frequency of overweight/obesity, $r_s(138) = .727$, $p = .000$. If examined by continent, the strongest correlation was measured in Asia $r_s(31) = .852$, $p = .000$, and the weakest in Europe $r_s(39) = .415$, $p = .009$. We find a significant difference between boys and girls on a global level, 8.67±5.37 percent of girls can be classified as obese, and 10.51±6.83% of boys, $t(280)=2.515$, $p=0.012$. Regarding overweight, we found no significant difference between the two sexes, 23.38±13.01% for boys and 22.83±10.36% for girls, $t(286)=0.398$, $p=0.691$. Analyzing the data by continent, we can reveal some interesting facts. In Europe, there are significantly more overweight and obese boys than girls $t(84)=2.906$, $p=0.005$. However, Europe is the only continent where we find significant differences between the two sexes in both categories. In North America, both boys and girls have high rates of overwseight and obesity. About 32% are overweight and about 14% are obese.

In South America and Asia, we find a difference between boys and girls, but this is not statistically significant. Africa is the only continent where the reverse trend prevails. Significantly more girls are overweight $t(78) = - 3.786$, $p = 0.000$ than boys (16.86±6.31% - 10.42±8.71%), likewise more girls are obese

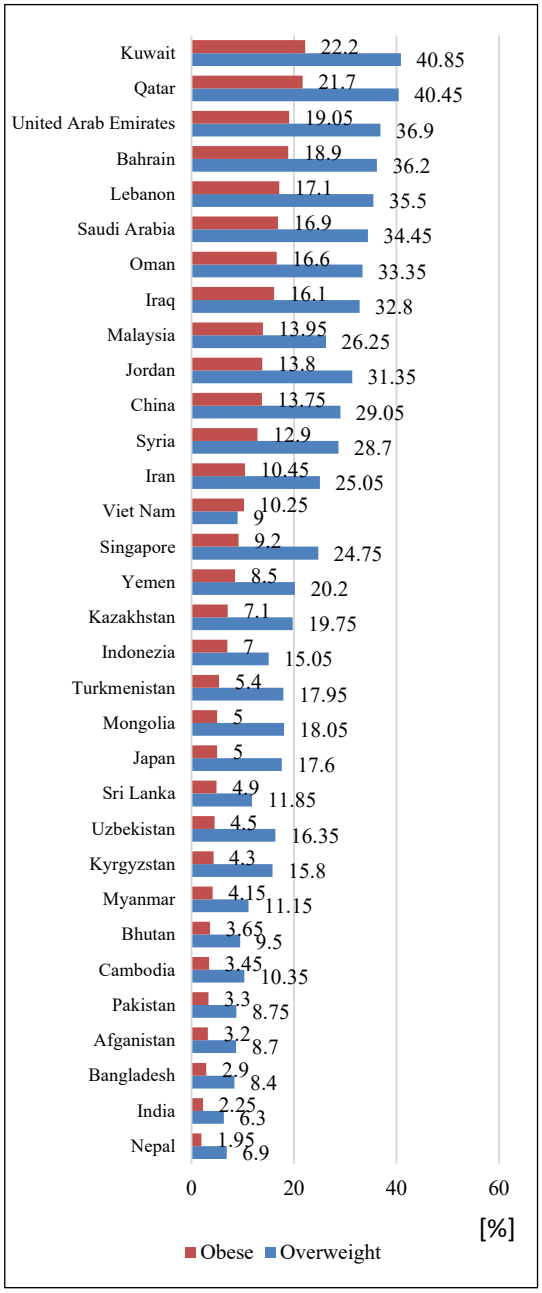

Figure 3. *Prevalence of overweight and obesity in Asia*

than boys, however the difference observed here is not statistically significant, t(78) = -1.511, p=0.135.

Discussion

For many decades, the complications of smoking were the leading cause of death (Banks, et al., 2015; Kuibao, et al., 2016). Today, it is considered that this is no longer true and most of the complications are due to obesity (Abdelaal, le Roux, & Docherty, 2017). Overweight and obesity are physical conditions that are caused by many factors. The two most common reasons would be bad eating habits and lack of exercise, but there are many other reasons that contribute to a greater or lesser extent. Hormonal disorders, sleeping habits, working conditions, mental state, etc (Hruby, et al., 2016). Just changing the time allocated to physical education at school will not necessarily significantly reduce the proportion of children struggling with overweight or obesity. Although the beneficial effect of regular physical exercise on health is indisputable, in order to reach an optimal level, regarding body weight, fitness level and well-being, in many cases it is not only a result of the time allocated for physical exercise, but also a specific lifestyle change, which may include our nutrition, rest and recreation habits (Reiner, Niermann, Jekauc, & Woll, 2013; Warburton, Nicol, & Bredin, 2006). Our analyzes also show that there is no connection

between the time devoted to physical education and the frequency of overweight/obesity.

Globally, the time devoted to physical education has decreased significantly in the last two decades. While around 2000 the average in Primary school was 116 minutes and in Secondary School 146 minutes, in 2007 it was 100 and 102 minutes respectively, and around 2013 it was 97 and 99 minutes respectively (UNESCO, 2013). These data fall far short of the recommendations derived from specific experimental research (150 minutes per week/at least 30 minutes per day). Africa and Asia are the two continents where the least amount of time is provided for physical education, on average barely exceeding 85 minutes per week. And most are allocated to physical education in Australia/Oceania and Europe.

It has long been known that people struggling with overweight and obesity are more common in more economically developed countries (Talukdar, Seenivasan, Cameron, & Sacks, 2020). This was also confirmed by our calculations, for all six continents.

In general, more boys are overweight and obese than girls. The exception to this is Africa, where the trend is reversed at the continental level (Adeboye, Bermano, & Rolland, 2012).

Conclusion

The average time devoted to physical education in the examined countries is 95.6±35.0 minutes per week. The minimum is 30 minutes and the maximum is 225 minutes. 90 minutes occurs with the greatest frequency. Significantly less time is devoted to physical education in schools in Asia and Africa than in the other four continents. A weak positive relationship can be discovered at the global level between the economic development of countries and the time devoted to physical education.

If we examine this relationship at the continental level, only Asia has a significant relationship between the two variables. The frequency of overweight and obesity shows large differences at the continental level. We come across cases where the combined frequency of the two categories barely reaches 10% (Nepal, India, Nigeria), but within the same continent this indicator can be as high as 60% (Egypt, Kuwait, Qatar). In the case of African and Asian countries, the frequency of overweight is mostly between 10-20% (with a few exceptions), while the frequency of obesity is roughly three times less than that of overweight. In the other continents, the gap between the prevalence of overweight and obesity is much smaller. In general, it can be stated that the frequency of overweight and obese children is significantly higher in economically developed countries than in less developed countries. This trend can be observed on all continents.

Limits of the study

The data used in the statistical analysis come from a reliable database, however, these are estimated values and not representative measurements across countries. The average values obtained for the continents may be distorted by the values of countries with large or small populations, since the data were not weighted depending on the number of the country's population.

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